ISSN: 2278-0181
ICACT - 2016 Conference Proceedings

Distributed Three-Hop Routing (DTR) Protocol in Hybrid Wireless Networks

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***Abstract:-* An efficient data routing protocol is important to the reliable communication between end users in wireless networks. However, the infrastructure wireless networks and ad-hoc wireless networks suffer from channel congestion in routings, failing to guarantee high transmission reliabilityThis paper presents a Distributed Three-Hop Routing Protocol (DTR) for hybrid wireless networks. To take full advantage of the widespread base stations, DTR divides a message data stream into segments and transmits the Theoretical analysis and simulation results show the superiority of DTR in comparison with other routing protocols in terms of throughput capacity, scalability and mobility resilience.**

Key Words: Hybrid wireless networks, Routing algorithm, Load balancing, Congestion control etc

1. INTRODUCTION

A hybrid wireless network consists of both an infrastructure wirelessnetwork and a mobile ad-hoc network (MANETs). Wireless devices suchas smart-phones, tablets and lap- tops, have both an infrastructureinterface and an ad- hoc interface. As the number of such devices hasbeen increasing sharply in recent years, a hybrid transmissionstructure will be widely used in the near future. The data is routedto its destination through the intermediate nodes in a multi-hopmanner. In the mobile ad-hoc network, with the absence of a centralcontrol infrastructure. In multi-hop routing The messages aretransmitted in wireless channels and through dynamic routing paths and this kind of routing needs on-demand route discovery or routemaintenance. For local area data transmission mobile ad-hoc networksare suitable.

To increases the throughput capacity of a wide-area wireless network ahybrid wireless network [1-6], combines together an infrastructure wirelessnetwork and a mobile ad-hoc network to use their advantages andovercome their shortcomings. A routing protocol is a criticalcomponent that affects the through- put capacity of a wireless networkin data transmission. Most current routing protocols in hybridwireless networks simply combine the cellular transmission mode (i.e.BS transmission mode) in infrastructure wireless networks and thead-hoc transmission mode in mobile ad-hoc networks. The protocols use the multi-hop routing [7-10] to forward amessage to the mobile gateway nodes that are closest to the BSes orhave the highest bandwidth to the BSes. The bandwidth of a channel isthe maximum throughput (i.e., transmission rate in bits/s) that can beachieved. The mobile gateway nodes then forward the messages to theBSes, functioning as bridges to connect the ad-hoc network and theinfrastructure network.

The direct combination of the two transmission modes inherits thefollowing problems that are rooted in the ad-hoc transmission mode.

1.1 Hot Spots

Since the most traffic goes through the same gateway, andthe flooding employed in mobile ad-hoc routing to discover routes mayexacerbate the hot spot problem. Hot spots are generated due to,mobile nodes only use the channel resources in their route direction,which may while leave resources in other directions under-utilized.Hot spots lead to and high data dropping rates, low transmission ratesand severe network congestion

1.2 High Overhead

The wireless random access medium access control (MAC) required inmobile ad-hoc net- works, which utilizes control handshaking and aback- off mechanism, increases the overhead. Route discovery andmaintenance encounter high overhead.

1.3 Low reliability

Noise interference and neighbor interference duringthe multi-hop transmission process cause a high data drop rate.Dynamic and long routing paths lead to unreliable routing. Longrouting paths increase the probability of the occurrence of pathbreakdown due to the highly dynamic nature of wireless ad-hocnetworks.
In achieving high throughput capacity and scalability in hybridwireless networks. these problems become an obstacle

Taking advantage of this feature, we proposea Distributed Three-hop Data Routing protocol (DTR). In DTR, a sourcenode divides a message stream into a number of segments. Each segmentis sent to a neighbor mobile node. Based on the QoS requirement, thesemobile relay nodes choose between direct transmission or relaytransmission to the BS. In relay transmission, a segment is forwardedto another mobile node with higher capacity to a BS than the currentnode. In direct transmission, a segment is directly forwarded to a BS.In the infrastructure, the segments are rearranged in their originalorder and sent to the destination. The number of routing hops in DTRis confined to three, including at most two hops in the ad-hoctransmission mode and one hop in the cellular transmission mode[11]. Toovercome the aforementioned shortcomings, DTR tries to limit thenumber of hops. The first hop forwarding distributes the segments of amessage in different directions to fully utilize the resources, andthe possible second hop forwarding ensures the high capacity of theforwarder. DTR also has a congestion control algorithm to balance thetraffic load between the nearby BSes in order to avoid trafficcongestion at BSes.

DTR significantly increases the throughput capacity and scalability ofhybrid wireless networks by overcoming the three shortcomings of theprevious routing algorithms.Using self-adaptive and distributedrouting with high- speed and short-path ad-hoc transmission, it hasthe following features:

- Hot Spot Reduction - It reduces the traffic congestion at mobile gateway nodes while makes full use of channel resources through a distributed multi-path relay
- Low overhead in a dynamic environment, it eliminates overhead caused by route discovery and maintenance in the ad-hoc transmission mode.
- High reliability. Because of its small hop path length with a shortphysical distance in each step, it reduces noise and neighborinterference and avoids the adverse effect of route breakdown duringdata transmission. Thus, it reduces the packet drop rate and makesfull use of spacial reuse, in which several source and destinationnodes can communicate simultaneously without interference.

2. DISTRIBUTED THREE-HOP ROUTING PROTOCOL

2.1 Assumption and Overview:

Since BSes are associated with a wired spine expect that there are no transmission capacity and force imperatives on transmissions between BSes. We utilize transitional hubs to mean transfer hubs that capacity as doors interfacing an infrastructure wireless network and a mobile ad-hoc network. We accept each mobile hub isdouble mode; that is, it has ad-hoc network interface suchas a WLAN radio interface and infrastructure networkinterface, for example, a 3G cellular interface.

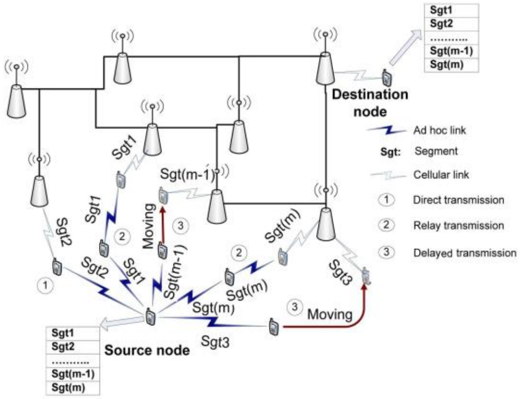

Figure. 2: Data transmission in the DTR protocol.

DTR intends to move the routing trouble from the adhoc network to the infrastructure network by taking advantage of widespread base stations in a half and half wireless network. Instead of utilizing one multi-jump way to forward a message to one BS, DTR utilizes at most two bounces to transfer the fragments of a message to various BSes in a disseminated way, and depends on BSes to join the fragments. We improve the routings in the infrastructure network for clarity.

As appeared in the ∂®ure, when a source hub needs to transmit a message stream to a destination hub, it partitions the message stream into various halfway streams called fragments what's more, transmits every portion to a neighbor hub. Upon accepting a portion from the source hub, a neighbor hub locally settles on direct transmission and hand-off transmission in view of the QoS prerequisite of the application. The neighbor hubs forward these portions in a circulated way to close-by BSes. Depending on the infrastructure network routing, the BSes further transmit the portions to the BS where the destination hub dwells. The last BS adjusts the fragments into the unique request and advances the portions to the destination. It utilizes the cellular IP transmission strategy to send portions to the destination if the destination moves to another BS amid portion transmission.

2.2 Uplink Data Routing:

In this work, we take throughput and routing speed as samples for the QoS prerequisite. We utilize a data transfer capacity/line metric to reflect hub limit in throughput and quick information sending. The metric is the proportion of a hub's channel transfer speed to its message line size. A bigger data transfer capacity/line esteem implies higher throughput and message sending velocity and the other way around.

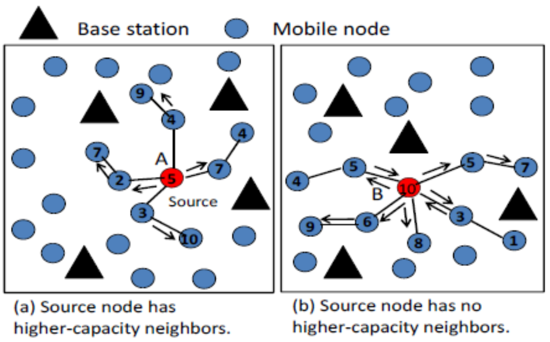

Figure. 2: Neighbor selection in DTR.

Figure. 2 indicates illustrations of neighbor determination in DTR, in which the source hub is in the transmission scope of a BS. In the figures, the worth in the hub speaks to its ability. In situation (a), there exist hubs that have higher limit than the source hub inside of the source's two-jump neighborhood. In the event that a routing calculation straightforwardly give a source hub a chance to transmit a message to its BS, the high routing execution can't be ensured subsequent to the source hub might have low limit. In DTR, the source hub sends sections to its neighbors, which further forward the sections to hubs with higher limits.

In situation (b), the source hub has the most elevated limit among the hubs in its two-bounce neighborhood. Subsequent to getting fragments from the source hub, a few neighbors forward the fragments back to the source hub, which sends the message to its BS. Along these lines, DTR dependably masterminds information to be sent by hubs with high capacity to their BSes. DTR accomplishes higher throughput what's more, quicker information sending speed by considering hub limit in information sending. DTR uses two phases of algorithm as mentioned below.Phase1 is the Algorithm 1 whichdescribes the pseudo-code for neighbor node selection and message forwarding in DTR.
Phase 2 is the Algorithm 2 which describes the Pseudo-code for a BS to reorder and forwardsegments to destination nodes.

Algorithm 1
Pseudo-code for neighbor node selection and message forwarding.

1: **ChooseRelay( ) {**
2: //choose neighbors with sufficient caches and bandwidth/queue (b/q) rates
3: Query storage size and QoS requirement info. from neighbors
4: **for** each neighbor n **do**
5: **if**n.cache.size>segment.length&&n.b/q>this.b/q **then**
6: Add n to R = {r1, . . . rm, ...} in a descending order of b/q
7: **end if**
8: **end for**
9: Return R
10: }
11: **Transmission( )** {
12: **if** it is a source node **then**
13: //routing conducted by a source node
14: //choose relay nodes based on QoS requirement
15: R=ChooseRelay( );
16: Send segments to {r1, . . . rm} in R
17: **else**
18: //routing conducted by a neighbor node
19: **if**this.b/q □ b/q of all neighbors **then**
20: //direct transmission
21: **if** within the range of a BS **then**
22: Transmit the segment directly to the BS
23: **end if**
24: **else**
25: //relay transmission
26: nodei=getHighestCapability(ChooseRelay( ))
27: Send a segment to nodei
28: **end if**
29: **else**

Algorithm 2
Pseudo-code for a BS to reorder and forward segments to destination nodes.

1: //a cache pool is built for each data stream
2: //there are n cache pools currently
3: **if** receives a segment (S,D,m,s,q) **then**
4: **if** there is no cache pool with msg sequence num equals m **then**
5: Create a cache pool n + 1 for the stream m
6: **else**
7: //the last delivered segment of stream m has sequence numi − 1
8: **if** s == i**then**
9: Send out segment (S,D,m,s,q) to D
10: i++;
11: **else**
12: Add segment (S,D,m,s) into cache pool m
13: **end if**
14: **end if**

2.3 Downlink Data Routing and Data Reconstruction:

As said over, the message stream of a source hubis separated into a few fragments. After a BS getsa segment, it needs to forward the fragment to the BS,where the destination hub dwells (i.e., the destinationBS). We utilize the mobile IP convention to empower BSes toknow the destination BS. In this convention, every mobilehub is connected with a home BS, which is the BS in thehub's home network, paying little heed to its present areain the network. The home network of a hub contains its enlistment data distinguished by its place of residence, which is a static IP address allocated by an ISP. In a Hybrid wireless network, every BS intermittently emanates reference point signs to find the mobile hubs in its reach.
At the point when a mobile hub mi moves far from its home BS,the BS where mi right now dwells recognizes mi and sendsits IP address to the home BS of mi. At the point when a BS needsto contact mi, it contacts the home BS of mi to discover thedestination BS where mi right now lives at.Nonetheless, the destination BS recorded in the home

BSmay not be the most forward destination BS since destination mobile hubs switch between the scope locales of various BSes amid information transmission to them. For example, information is transmitted to BS Bi that has the information's destination, however the destination has moved to the scope of BS Bj before the information lands at BS Bi.

To manage this issue, we adopt the Cellular IP convention for following hub areas. With this convention, a BS has home specialists and remote operators. The remote specialists monitor mobile hubs moving into the scopes of different BSes. The home specialists blocks in-coming sections, recreates the first information, and re-courses it to the remote specialists, which then advances the information to the destination mobile hub. After the destination BS gets the sections of a message, it reworks the sections into the first message and afterward sends it to the destination mobile hub. A basic issue is ensuring that the sections are consolidated in the right request. For this reason, DTR indicates the fragment structure group. Every section contains eight fields, including: (1) source hub IP address (signified by S); (2) destination hub IP address (signified by D); (3) message succession number (indicated by m); (4) portion succession number (signified by s); (5) QoS sign number (signified by q); (6) information; (7) length of the information; and (8) checksum. Fields (1)- (5) are in the portion head. The part of the source IP address field is to educate the destination hub where the message originates from. The destination IP address field shows the destination hub, and is utilized to find the last BS. In the wake of sending out a message stream to a destination, a source hub might convey another message stream to the same destination hub.

The message arrangement number separates the distinctive message streams started by the same source hub. The portion arrangement number is utilized to discover the right transmission arrangement of the portions for transmission to a destination hub. The information is the real data that a source hub needs to transmit to a destination hub. The length field determines the length of the DTR portion incorporating the header in bytes. The checksum is utilized by the beneficiary hub to check whether the got information has blunders. The QoS sign number is used to demonstrate the QoS necessity of the application.

2.4 Congestion Control in Base Stations

Contrasted with the past routing calculations in cross breed wireless networks, DTR can disseminate movement load among mobile hubs all the more equally. In spite of the fact that the disseminated routing in DTR can circulate activity load among close-by BSes, in the event that the activity load is not disseminated equitably in the network, some BSes might get to be overloaded while different BSes remain delicately loaded. We propose a clog control calculation to abstain from overloading BSes in uplink transmission and downlink transmission, individually. In the mixture wireless network, BSes send reference point messages to recognize adjacent mobile hubs. Taking advantage of this guide procedure, once the workload of a BS, say Bi, surpasses a pre-characterized limit, Bi adds an additional bit in its reference point message to broadcast to every one of the hubs in its transmission range. At that point, hubs close Bi know that Bi is overloaded a won't forward portions to Bi. At the point when a hub close Bi, say mi, needs to forward a portion to a BS, it will send the section to Bi in light of the DTR calculation. In our blockage control calculation, since Bi is overloaded, as opposed to focusing on Bi, mi will forward the portion to a delicately loaded neighboring BS of Bi. To this end, hub mi first questions a multi-bounce way to a gently loaded neighboring BS of Bi. Hub mi broadcasts a question message into the framework. We set the TTL for the way question sending venture to a consistent.

The question message is sent along other hubs until a hub (say mj) close to a delicately loaded BS (say Bj) is come to. Because of broadcasting, a hub might get numerous duplicates of the same inquiries. Every hub just recollects mi and the hub that advances the first question (i.e., its previous hub), and disregards all other the same questions. Along these lines, a multi-bounce way between the source hub and the softly loaded base station can be shaped. Hub mj reacts to the way question by adding an answer bit and the address of mi into its signal message to its previous hub in the way. This guide collector likewise adds an answer bit and the address of mi into its guide message to its previous hub in the way. This process rehashes until mi gets the guide.

Hence, each hub knows its first hub and succeeding hub in the way from mi and mj in view of the address of mi. At that point, mi's message can be sent along the watched way along the hubs. The watched way can continuously utilized by mi for any resulting messages to Bj the length of it is not broken. The neighboring BSes of an overloaded BS might likewise be overloaded. As the mobile hubs almost an overloaded BS realize that the BS is overloaded, when they get a question message to discover a way to an under loaded BS, they don't forward the message towards their overloaded BSes.

Keeping in mind the end goal to diminish the broadcasting overhead, a mobile hub living in the locale of a BS not near the destination BS drops question. The hubs can decide their surmised relative positions to BSes by detecting the sign qualities from various BSes. Every hub adds the quality of its got signal into its guide message that is intermittently traded between neighbor hubs so that the hubs can recognize their relative positions to one another. Just those mobile hubs that stay more distant than the question forwarder from the forwarder's BS forward the inquiries in the bearing of the destination BS. Along these lines, the inquiry can be sent to the destination BS speedier. After the multi-bounce way is found, the neighboring BS sends the section to the destination hub along the way. Subsequent to the destination hub is in the neighboring BS's district, the overhead to distinguish a way to the destination hub is little. Note that our strategies for blockage control in base stations include inquiry brbroadcasting.be that as it may, it is utilized just when some base stations are overloaded instead of in the ordinary DTR routing calculation with a specific end goal to stay away from load clog in BSes.

3. CONCLUSION

Hybrid wireless networks have been accepting expanding consideration as of late. A half and half wireless network joining an infrastructure wireless network what's more, a mobile ad-hoc network influences their advantages to build the throughput limit of the framework. Be that as it may, current Hybrid wireless networks essentially consolidate the routing conventions in the two sorts of networks for information transmission, which keeps them from accomplishing higher framework limit. In this paper, we propose a Conveyed Three-jump Routing (DTR) information routing convention that incorporates the double components of cross breed wireless networks in the information transmission process. In DTR, a source hub partitions a message stream into fragments and transmits them to its mobile neighbors, which encourage forward the fragments to their destination through an infrastructure network. DTR limits the routing way length to three, and dependably masterminds high-limit hubs to forward information. Dissimilar to most existing routing conventions, DTR creates essentially bring down overhead by killing course disclosure and support. In addition, its recognizing attributes of short way length, short-remove transmission, and adjusted load appropriation give high routing unwavering quality and effectiveness. DTR likewise has a blockage control calculation to keep away from load blockage in BSes on account of uneven movement disseminations in networks. Hypothetical examination and reenactment results demonstrate that DTR can drastically enhance the throughput limit and adaptability of half and half wireless networks because of its high adaptability, effectiveness, and dependability and low overhead.

4. REFERENCES

[1]. H Luo, R. Ramjee, P. Sinha, L. Li, and S. Lu. Ucan: A unified cell and ad-hoc network architecture. In Proc. of MOBICOM, 2003
[2]. P. K. McKinley, H. Xu, A. H. Esfahanian, and L. M. Ni. Unicast based multicast communication in wormhole-routed direct networks. TPDS, 1992.
[3]. H.Wu, C.Qiao, S. De, and O. Tonguz. Integrated cell and ad hoc relaying systems: iCAR. J-SAC, 2001.
[4]. Y. H. Tam, H. S. Hassanein, S. G. Akl, and R. Benkoczi. Optimal multi-hop cellular architecture for wireless communications. In Proc. of LCN, 2006.
[5]. Y. D. Lin and Y. C. Hsu. Multi-hop cellular: A new architecture for wireless communications. In Proc. of INFOCOM, 2000.
[6]. P. T. Oliver, Dousse, and M. Hasler. Connectivity in ad hoc and hybrid networks. In Proc. of INFOCOM, 2002.
[7]. E. P. Charles and P. Bhagwat. Highly dynamic destination sequenced distance vector routing (DSDV) for mobile computers. In Proc. Of SIGCOMM, 1994.
[8]. C. Perkins, E. Belding-Royer, and S. Das. RFC 3561: Ad hoc on demand distance vector (AODV) routing. Technical report, Internet Engineering Task Force, 2003.
[9]. D. B. Johnson and D. A. Maltz. Dynamic source routing in ad hoc wireless networks. IEEE Mobile Computing, 1996.
[10]. V. D. Park and M. Scott Corson. A highly adaptive distributed routing algorithm for mobile wireless networks. In Proc. INFOCOM, 1997.
[11]. A.G.Valko. Cellular ip: A new approach to internet host mobility. ACM Computer communications, 1999.